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THE RELATION BETWEEN THE LEAFROLL VIRUS AND NET-NECROSIS OF POTATOES[1]

A. A. Soliman[2]

Introduction

The true nature of the relation between leafroll and net-necrosis of potatoes has not been revealed to date. Several authors tried to investigate the problem in different ways and gave various explanations without being able to reach a satisfactory conclusion. The commonly accepted view is that developed by the group of workers of the Maine Experiment Station. Schultz and Folsom (1921), maintaining that the net-necrosis is the first year symptom of leafroll. Other authors claim that different factors, including the storage conditions, determine the appearance of the necrotic condition. Ross *et al* (1947) consider the nature of the soil and the types of fertilizers as the main factors that determine the amount of net-necrosis that appears in a potato crop.

However, in no case were the factors that are suspected to play a role in determining the relation between the two phases of the disease thoroughly investigated. In the present study such a relation was sought by experimental procedure. Some of the suspected factors were studied, such as the effect of combination of different virus entities, the subsequent reinfection with leafroll, as well as the time of infection with reference to plant growth and development. During the preparation of this manuscript a preliminary note by Rich (1949), dealing with the effect of one of these factors, namely the time of infection, appeared in the literature. Although the author in that paper seems to have reliable results as far as the time factor of infection is concerned, the size of the tubers at the time of infection, which is a very important factor in the problem was not given due consideration. Varieties of potato differ in the rate at which they develop their tubers. Furthermore the same variety may have varying rates of formation of tubers under different growing conditions. These and other factors may have some effect on the time factor of infection.

In the present study certain factors which were suspected to determine the relation between leafroll and net-necrosis were investigated, and the brief analysis of these are here presented.

Effect of Combination of Viruses

The consideration of the effect of combination of viruses in the association of leafroll with net-necrosis represents quite a new approach to the problem. The fact that almost all potato varieties are natural carriers of the latent virus X, makes it difficult to determine whether or not leafroll alone, as separated from X, is capable of causing net-necrosis of the tubers.

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Published with the approval of the Director of the Minnesota Agricultural Experiment Station, a Paper No. 2845 in the Scientific Journal Series.

[2]Entomology Department, Faculty of Science, University of Alexandria, Egypt. Formerly a graduate student at the University of Minnesota and a scholar from the Government of Egypt. This work is a part of the research problem in fulfillment of the requirements for the degree of Doctor of Philosophy.

In the present work experimental tests were made possible by working with X-free potato tubers obtained from the Maine Experiment Station. Through the courtesy of Dr. E. S. Schultz, tubers infected with Y virus, A virus, mild strain of X virus, and common X virus were obtained for this study.

Five sets of 25 plants each were raised under cages in the greenhouse. Each set of young plants was subjected to a different treatment, giving the following series:

1. Healthy plants (X-free) were infected only with leafroll virus.
2. Plants with virus A were inoculated with the leafroll virus.
3. Plants with virus Y were infected with the leafroll virus.
4. Plants with X (common strain) were infected with the leafroll virus.
5. Plants with virus X (mild strain) inoculated with leafroll virus.

In each of the above cases leafroll virus was transmitted by aphids, *Myzus persicae*, Sulzer, from a viruliferous source of Green Mountain potato plants. Plants when inoculated were about one month old, the stage at which infection is more likely to lead to the appearance of net-necrosis as was determined in another experiment in the course of this study. In each case leafroll virus was inoculated into the plants that already possessed the different virus entities by transferring viruliferous aphids to these plants. The results arrived at are expressed in terms of percentage of net-necrosis found present by testing fluoroscopically the progeny tubers of the infected plants. The potato tubers produced by the different plant lots were kept in storage separately for about one month. Then they were examined fluoroscopically for the presence of net-necrosis, with the results shown in table 1.

Other combinations such as X and Y, and X and A were not suspected to have any effect in production of net-necrosis, since they are known to cause quite different types of diseases on potatoes, namely rugose and crinkle mosaic, respectively.

From the above results it seems that both the Y and A viruses check the effect of leafroll on the production of net-necrosis considerably. The data indicate that there is a sort of immunization reaction conveyed to the plants by A and Y viruses against the leafroll virus. From these results it can also be concluded that the presence of X-virus is not necessarily a requirement for the appearance of net-necrosis. Leafroll virus alone in the absence of X virus can produce necrosis to approximately the same extent when the latent virus is present in tubers.

TABLE 1.—*The percentage of net-necrosis produced by potato plants infected by different combination of viruses.*

Virus Combination Used	Number of Tubers Tested	Percentage Net Necrosis
1. Leafroll alone	150	20
2. Leafroll and X (mild)	100	25
3. Leafroll and X (common)	200	20
4. Leafroll and A virus	120	5
5. Leafroll and Y virus	100	8

It should be pointed out that the percentage of necrosis yielded by the virus infection in this experiment is very low. This may be due to the fact that the plants were raised under greenhouse conditions and not all of the tubers had a chance to reach maturity, a factor which may have an effect on the results. This test suggests further investigation on the effect of the time of infection along with the development of the size of the tubers at the time of infection, as factors that might determine the amount of net-necrosis shown in tubers at the time of harvesting or in subsequent storage.

Effect of Time of Infection

Among the many factors that determine the relation between leafroll and net-necrosis is the effect of the time of infection of the potato plants. It was not until very recently that such an investigation was made by Rich (1949) although similar studies were in progress on the same subject by the author. Indeed, that factor in the production of net-necrosis was suggested for investigation in the present studies before Rich's work appeared. Preliminary experiments in the course of these studies showed that the time of infection has an effect on the amount of net-necrosis in tubers of infected plants. Further investigations were conducted to find the correlation between the time of infection, the size of the tubers at the time of infection, and the amount of net-necrosis.

Several sets of 8 healthy potato plants were inoculated with leafroll virus at various periods of plant development for the purpose. One set was inoculated at the beginning of emergence, another after one month of growth, the third at the beginning of the tubers, the fourth after two months of development when the tubers have nearly reached their full size, and the fifth at the close of the developmental period, 15 days before harvest.

Although results cannot be considered conclusive because of the fact that the experiment was carried on only on a narrow scale, yet they indicate that there is a period in the developmental growth of the potato plant during which the tubers are more susceptible to infection with the net-necrosis than at any other time, either earlier or later. This period is considered critical in the plant growth as far as the subsequent development of net-necrosis accompanying infection with leafroll virus is concerned. This critical interval seems to be the time during which the tubers are formed. The infection in storage or at emergence resulted in a very low percentage of net-necrosis of infected tubers, only about 5 per cent, in comparison with the relatively high percentage shown as a result of infection of the plants anywhere during the so-called critical period, when tubers are formed. Plants infected during that period showed about 2.5 per cent of net-necrosis. Very late inoculation again resulted in a practically negligible amount of net-necrosis.

Further investigations of these interesting and important points should be made in order to analyze very thoroughly the importance of different periods of plant growth in the susceptibility of plants to leafroll and net-necrosis. Complete investigation of the relation between the size of the developing tubers at the time of inoculation and the resulting percentage of the net-necrotic tubers is worthy of future consideration.

Effect of Reinoculation

Reinfection of the Tubers: The obscure relation between the potato plants infected with leafroll and the symptoms of net-necrosis in resulting tubers necessitates a careful investigation from every possible point of approach. Doubtless, this relation is affected by several factors. It is challenging enough and presents a need for studying the problem from as many approaches as possible in order to determine the effect of various factors on production of this type of tuber discoloration. Among the various factors suspected that may affect this relationship is the reinoculation (reinfection) of already diseased plants with the same virus.

Although it is assumed that the infection of a plant with one virus immunizes that plant against infection with similar virus entities, yet a reinfection with leafroll of a diseased plant at different periods of its growth may as well be looked upon as giving the plant an extra dose of the inoculum at a vulnerable time. The effect of such reinoculation was of interest. It was first thought that such a treatment may cause the appearance of a net-necrotic condition in progeny of tubers that originally harbor the virus without showing a net-necrotic condition.

With this in view, a lot of 100 tubers of the Green Mountain variety, known to have been diseased originally with leafroll virus was reinoculated in storage by infesting them with viruliferous aphids, *Myzus persicae*, Sulzer. This experimental infestation was carried on at the Maine Experiment Station by the author. Facilities for conducting this work were made available through the courtesy of several members of that Station's staff, especially Dr. Bonde, Dr. Schultz and Dr. Simpson. The tubers thus treated were later planted in the greenhouse of the University of Minnesota. Also 50 tubers diseased with leafroll from the same source, as the treated ones, were planted as a control without being reinfected. The progeny of the two lots were treated fluoroscopically.

The results indicate that reinfection of diseased tubers in storage prior to planting cannot produce net-necrosis in the tubers' progeny. Of 220 tubers yielded by reinfected tubers the net-necrosis showed up only in approximately 2 per cent. Likewise, of 100 tubers produced from the non-reinfected tubers only two showed some discoloration.

Reinfection of the plants: During the summer of 1949, the leafrolled plants were again reinfected with leafroll virus by transferring aphids to plants when they were about one month old and growing under 20 field cages at the University Farm, Minnesota. The progeny of these 40 plants, two per cage, were treated fluoroscopically. None of the tubers thus produced showed the net-necrosis, indicating that as in the case of reinfection of tubers in storage, the reinfection of viruliferous plants cannot account for the appearance or development of the net-necrosis. Therefore it is evident that the net-necrotic condition of tubers is by no means dependent upon the amount of inoculum injected into the plant.

It is also well established that the net-necrotic condition shows up only in tubers that are yielded by plants which become infected for the first time. It is the first year infection with the leafroll virus that results in discoloration of the tubers. Progeny of tubers that show the net-necrotic condition will never show this condition again (Schultz & Folsom—1921, Varney—1943 and others).

Summary

The relation between the leafroll virus and net-necrosis of potatoes as far as the effect of combination of viruses, the effect of time of infection, and the effect of reinoculation was carried on in the present study. It was found that the presence of latent virus X of potatoes does not affect the incidence of net-necrosis of potatoes. The percentage of net-necrosis in the tuber progeny of current year infected plants does not vary considerably in the presence or absence of the common or mild strains of virus X. In case of infection with leafroll alone the tubers showed 20 per cent net-necrosis. In the presence of a mild strain of X virus in addition to the leafroll, the net-necrosis reached 25 per cent, whereas in the presence of a common strain of X virus 20 per cent of resulting tubers showed net-necrosis. The presence of either virus A or Y seems to immunize the tubers against infection with net-necrosis when the leafroll virus is inoculated into plants that are already infected with one or the other of these two viruses. In the presence of Y virus in combination with leafroll, the yielded tubers showed 8 per cent of net-necrosis. In case where A virus was present in combination with leafroll, only 5 per cent of the tubers showed net-necrosis.

The amount of net-necrotic tubers that are produced from infected plants was found to depend to a great extent on the time at which the infection took place during the growth of plants and on the developmental stage of the tubers at the time of infection. The leafroll infection is more likely to bring about the maximum number of net-necrotic tubers when it takes place during the middle part of the growing season, when tubers are setting.

Reinoculation of the diseased potato tubers before planting or the growing of already diseased plants did not result in the appearance of the net-necrotic condition in their progeny.

Acknowledgments

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THE EFFECTIVENESS OF REDUCED DOSAGE LEVELS OF ACTIVATED CARBON IN COUNTERACTING THE OFF-FLAVOR IN POTATOES GROWN ON SOIL TREATED WITH BENZENE HEXACHLORIDE[1]

EDNA SAKAMOTO WHITE AND MARY L. GREENWOOD[2,3]

Preliminary tests have shown that activated carbon (charcoal) when applied at a level of one ton per acre to benzene hexachloride-treated soil showed a definite ability to counteract the characteristic off-flavor in potatoes (*2*). Since the cost of this rate of treatment is prohibitive to potato growers, tests were carried out to determine whether much smaller dosage levels of activated carbon would counteract the effects of benzene hexachloride.

PROCEDURE

Potatoes grown in experimental plots were obtained from the Connecticut Agricultural Experiment Station at New Haven. The soil in different plots had been treated with various levels of benzene hexachloride in different years as noted in table 1. Activated carbon in dosages of 10, 50, and 100 pounds per acre was applied to the soil in 1950. Potatoes were also grown on untreated soil and on unantidoted benzene hexachloride-treated soil. The Katahdin variety was used throughout all tests.

TABLE 1.—*Levels of benzene hexachloride and activated carbon and the year of application.*

Benzene Hexachloride		Activated Carbon		Test No.
Pounds per Acre	Year Applied	Pounds per Acre	Year Applied	
2	1948	10, 50, 100	1950	1, 2
2.5	1950	"	"	3, 4
4	1948	"	"	5, 6
7.5	1946	"	"	7, 8
37.5	1946	"	"	9, 10

Twelve potatoes from each treatment were baked at 425° F. until tender, as indicated by a cake tester. Baking periods varied from 30 minutes to one hour and 22 minutes depending on the size of the potato. The potatoes were quartered from blossom to stem end, and selected to make up a representative sample. The contents from one quarter of each potato were mashed and mixed with a fork to make a homogenous sample.

[1]Accepted for publication September 5, 1952.
[2]School of Home Economics.
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The samples in each taste test consisted of potatoes grown in soil treated with one dosage level of benzene hexachloride and subsequently with three levels of activated carbon—10, 50, and 100 pounds per acre. There were two taste tests for each benzene hexachloride dosage level, each test comparing three samples of potatoes grown in antidoted soil and a control sample of potatoes grown in untreated soil. The samples were arranged in a 4 x 4 latin square, columns representing the order of tasting, rows the groups of tasters, and letters the treatments. Labelled reference samples of the control and unantidoted benzene hexachloride-treated potatoes were available to aid the tasters in identifying the off-flavor due to benzene hexachloride.

The tasters reported for each sample the presence or absence of the off-flavor due to benzene hexachloride with plus or minus signs and the degree of intensity with an increasing number of plus signs. Twenty-three to thirty tasters, consisting of students and staff members of the University of Connecticut, participated in each test. Since all the tasters were not sensitive to the flavor of benzene hexachloride, as indicated by their scores and comments, tasters were then screened on the basis of their results. Individuals who participated in several tests and failed to give the control sample a minus more than one-third of the time were omitted, as were those who gave the same score to all four samples.

As in an earlier report (2), the plusses and minuses from the score sheets were changed to the scores for ordinal data in a set of four with table XX in Fisher and Yates (1). Minuses were given the lowest scores and tied values were averaged. After deleting the "insensitive" tasters, the number of individuals differed from row to row in the latin square for each day, so that the data were analyzed in terms of the mean score in each cell of the square.

Results and Discussion

When activated carbon was applied in dosages of 10, 50, and 100 pounds per acre to various levels of benzene hexachloride-treated soil, the antidoted samples still showed significantly more off-flavor than the untreated control (Table 2). The effectiveness of the activated carbon was not significantly greater at the lower than at the higher levels of benzene hexachloride applied in the same year. Nor did the three dosage levels of activated carbon show an increasing antidoting effect at any one level of benzene hexachloride. It therefore appears from the present experiments that the dosages of activated carbon were not large enough to counteract the effects of benzene hexachloride nor to produce detectable differences between dosage levels.

A somewhat similar study conducted at the Connecticut Agricultural Experiment Station in New Haven with potatoes grown on the same plots a year later did show a graded response. Dosages of 50 to 200 pounds of carbon per acre on soils previously treated with benzene hexachloride at the rate of 2½ pounds per acre were said to be sufficiently effective to allow production of palatable potatoes. However, similar amounts of carbon applied to soils treated with 7½ and 37½ pounds of benzene hexachloride were not completely effective (3).

The order of tasting did not have a significant effect on the off-flavor

TABLE 2.—*Totals of the mean scores from the four groups in each test, showing the effectiveness of activated carbon in counteracting the off-flavor of potatoes grown on benzene hexachloride-treated soil, independently of order of tasting.*

Test No.	Benzene Hexachloride		No. of Tasters	Mean Scores				Significance: Control *vs.* Antidoted Samples (1 df.)
	Lb./Acre	Year of Application		Control (No Treatment)	Activated Carbon: Pounds per Acre			
					100	50	10	
1	2	1948	16	—2.229	—0.771	2.669	0.367	P<.01
2	2	1948	12	—1.805	1.380	—1.075	1.527	P<.05
Subtotal				—4.034	0.609	1.594	1.894	
3	2.5	1950	15	—1.795	—0.246	1.986	0.081	P<.05
4	2.5	1950	14	—2.242	0.107	1.527	0.623	P<.10
Subtotal				—4.037	—0.139	3.513	0.704	
5	4	1948	17	—2.032	1.235	0.218	0.595	P<.10
6	4	1948	13	—1.935	1.081	1.815	—0.938	P<.10
Subtotal				—3.967	2.316	2.033	—0.343	
7	7.5	1946	16	—1.818	—0.408	1.526	0.720	P<.10
8	7.5	1946	13	—2.308	1.765	0.128	0.442	P<.05
Subtotal				—4.126	1.357	1.654	1.162	
9	37.5	1946	13	—2.233	—0.026	1.145	1.128	P<.01
10	37.5	1946	14	—1.913	1.450	—0.557	1.044	P<.001
Subtotal				—4.146	1.424	0.588	2.172	
Total				—20.310	5.567	9.382	5.589	P<.001

score on individual test days, as measured by the columns in the 4 x 4 latin squares representing order of tasting. However, when the overall totals were compared the response to off-flavor decreased significantly ($P<.01$) and linearly with order of tasting (Table 3). Apparently the benzene hexachloride flavor in the samples tasted first tended to decrease the response to off-flavor in subsequent samples, in contrast to reports that the flavor of benzene hexachloride from samples tasted first carried over to check samples tasted later.

TABLE 3.—*Total of the mean scores of all 10 tests for order of tasting.*

Order of Tasting				Significance of Linear Term
1	2	3	4	
4.094	2.287	—2.381	—3.772	$P<.01$

SUMMARY AND CONCLUSIONS

The effectiveness of different amounts of activated carbon applied to benzene hexachloride-treated soil in preventing off-flavor in potatoes grown on that soil has been studied with palatability tests. Activated carbon in dosages of 10, 50, and 100 pounds per acre did not eliminate the off-flavor in potatoes grown in soil treated with benzene hexachloride at 2, 2.5, 4, 7.5, and 37.5 pounds per acre up to four years earlier. Moreover, in these experiments there was no differential response to the various levels of activated carbon and no relation between the effectiveness of activated carbon and the level of benzene hexachloride applied originally to the soil. The flavor of benzene hexachloride from the samples tasted first tended to decrease rather than increase the off-flavor score in succeeding samples in the same test.

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EFFECT OF SPROUT INHIBITORS ON THE INCIDENCE OF FUSARIUM DRY ROT AND SPROUTING OF POTATO TUBERS[1]

J. HOWARD ELLISON AND H. S. CUNNINGHAM[2]

During the 1946-1947 storage season Fusarium dry rot of potatoes was a problem on Long Island. In examining potato tubers it was observed that the Fusarium infection was more prevalent in tubers treated with a sprout inhibitor containing methyl ester of a-napthaleneacetic acid (MENA) than in untreated potatoes. Brown (1) reported in England that a dust containing tetrachloronitrobenzene (TCNB) was very inhibitory to potato sprouting. The work reported in this paper was done to obtain information on the influence of sprout inhibitors containing MENA and TCNB on Fusarium dry rot and sprout growth of potatoes in storage.

MATERIALS AND METHODS

1950 Bin Experiment: This experiment was set up October 21 and 23, 1950 in the cellar of a greenhouse headhouse. The temperature varied between 60 and 70° F. for the first month of storage, and dropped approximately ten degrees to vary between 50 and 60° F. for the remainder of the storage period. Relative humidity usually ran between 80 and 90 per cent, except during periods of ventilation, when it fell as low as 60 per cent.

Green Mountain potatoes, which were harvested on October 20 and 23 and graded over a 1⅞" chain, were treated as they were placed in bins of 25-bushel capacity. Four replications were used, making a total of 16 bins, containing 400 bushels of potatoes. Treatments consisted of methyl ester of a-napthaleneacetic acid (MENA) at 1 gram per bushel (2.2 per cent dust), 2,3,5,6-tetrachloronitrobenzene (TCNB) at 1 gram per bushel (2.2 per cent dust), TCNB at 2.7 grams per bushel (6 per cent dust) and untreated control.

In studying the effect of sprout inhibitors on the incidence of Fusarium dry rot, the tubers were inoculated with a soil culture of *Fusarium sambucinum f.6* prepared several weeks in advance. The tubers were first injured by scraping on a vegetable grater, and inoculated either by rubbing the injured surface in the infested soil or by sprinkling this soil on the injured surface. Treatments were applied by dusting the sprout inhibitor over the tubers immediately following inoculation.

Inoculated tubers were then placed in cages of one cubic foot capacity made from one-half inch mesh wire screen. Two cages were placed in each storage bin, one in the center and one on the outer edge. The cage placed on the outer edge was divided by a partition, in order to study

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The authors are indebted to the Sterling-Winthrop Research Institute, Rensselear, N. Y., for contributing a Research Grant in support of this study, and for supplying the TCNB (Fusarex). Appreciation is expressed also to the American Cyanamid Company, 30 Rockefeller Plaza, New York, N. Y. for contribution of the MENA (Barsprout) used in this study.

any effect which position in the bin might have on incidence of the disease. The cages were arranged in the bins so that the sprout inhibitor treatments in the cages coincided with the treatments in the bins. Approximately 18 inches of potatoes lay beneath the wire cages, and another 18-inch layer rested on top of the cages. On February 20, 1951, the experiment was concluded. The wire cages were removed in order to study the incidence of Fusarium infection in the bruised, inoculated tubers. In addition, two samples of 50 tubers each were removed from the inner portions of each bin for sprout growth measurements.

1951 Bin Experiment: Katahdin potatoes were used in this experiment, which was set up in a cooperator's common storage on October 22, 1951. Sprout inhibitor's were applied as follows: MENA at 1 gram per bushel (2.2 per cent dust), TCNB at 2.7 grams per bushel (3 per cent dust), TCNB at 2.7 grams per bushel (6 per cent dust) and untreated control. Four replications of the 25-bushel capacity bins were used as in the 1950 experiment. Tubers were bruised and inoculated with a *Fusarium sambucinum f.6* soil culture as described above for the 1950 experiment. Wire cages containing the bruised, inoculated tubers were buried in each of the 16 bins in the same manner as in the 1950 experiment.

The temperature varied between 50 and 60° F. during the first three or four weeks of storage, and gradually dropped to a range of 35 to 45° F. during the remaining storage period. Relative humidity averaged approximately 80 per cent, varying from 70 to 90 per cent. On February 8, 1952 the experiment was concluded.

Two 50-tuber samples were taken from the inner portions of each bin for sprouting studies, and the cages were removed for examination of the inoculated tubers in regard to incidence of Fusarium infection.

1951 Paper Bag Test: On October 23, 1951 a test was set up in which small lots of Katahdin tubers were treated with MENA at one gram per bushel (2.2 per cent dust) and TCNB at 2.7 grams per bushel (3 per cent dust). Two samples of MENA were used, one being new and the other approximately 4 years old. The old MENA had been stored in a closed cardboard drum. Each lot consisted of 12 tubers in a paper bag and the treatments were replicated six times. Untreated tubers served as controls. The test was set up in a common storage beside the 1951 bin experiment described above (see above for temperature and humidity conditions). On May 7, 1952 the sprouts were removed from all lots and weighed to the nearest gram.

Results

1950 Bin Experiment: Sprouting was significantly retarded by TCNB at 2.7 grams per bushel and by MENA at one gram per bushel compared to the control, but TCNB at one gram per bushel failed to retard sprouting significantly (Table 1). Tubers treated with MENA and the high rate of TCNB were in very good condition at the end of the storage period, whereas untreated tubers and those treated with the low rate of TCNB were becoming quite flaccid.

Results concerning Fusarium dry rot are given in table 2. If we consider the means for treatments, TCNB at the strength used did not significantly increase the percentage of tubers infected with Fusarium as compared with the untreated control. Although not statistically significant

TABLE 1.—*Mean weight of sprouts per 100 tubers stored from October 2, 1950 to February 20, 1951. Green Mountain variety.*

Inhibitors	Grams
MENA (1 gm./bu.)	37
TCNB (1 gm./bu.)	170
TCNB (2.7 gms./bu.)	85
Untreated control	242
L.S.D. at .05	101

the trend was to increase infection rather than decrease it. In the case of MENA the increase in percentage of infected tubers was highly significant.

Concerning position in the bin, MENA had the same effect regardless of position. TCNB, on the other hand, showed a significant increase in the percentage of infected tubers from the center to the outside of the bin.

1951 Bin Experiment: Sprouting was controlled very effectively by all three treatments in this experiment (Table 3). There was no significant difference between MENA at 1 gram per bushel, TCNB at 2.7 grams per bushel (3 per cent dust) and TCNB at 2.7 grams per bushel (6 per cent dust). Control tubers sprouted significantly more than the treated tubers.

The percentage of tubers infected with Fusarium was very much higher in the 1951 experiment than in the previous year (Table 4). The trend, however, was the same. TCNB again was not significantly different from the untreated check, whereas the percentage infected tubers was significantly higher where MENA was used. In this experiment position in the bin apparently had no bearing on the result.

1951 Paper Bag Test: MENA at one gram per bushel and TCNB at 2.7 grams per bushel retarded sprout growth of Katahdin tubers in paper bags very markedly compared to the control (Table 5). This was true whether the MENA was recently formulated or was four years old.

DISCUSSION

The data presented in this paper show that Fusarium dry rot is more prevalent in stored potatoes treated with a sprout inhibitor containing methyl ester of a-napthaleneacetic acid than in untreated tubers stored under the same conditions.

Cunningham (1) has shown that this increase in the amount of dry rot is due to the action of the active agent in retarding, or even inhibiting, formation of wound cork which normally forms a natural barrier against the penetration of *Fusarium*. He also showed that when sprout inhibitors were used in excess, the effect on wound cork formation was more marked than with a smaller dosage.

Dust forms of sprout inhibitors are usually applied to potatoes going into storage at the point where the tubers are dropped on to the bin loader. As the tubers drop off the bin loader to the storage pile the surplus dust is deposited in this region and it is at this point that

TABLE 2.—*Percentage of tubers infected with Fusarium expressed as the means of four replications. Green Mountain variety, 1950.*

Inhibitors	Position in Bin			
	Outer Half	Inner Half	Center	Mean
MENA (1 gm./bu.)	80	79	80	80
TCNB (1 gm./bu.)	67	42	32	46
TCNB (2.7 gms./bu.)	61	49	34	48
Untreated control	48	38	36	41
Mean	64	52	46	
L. S. D. for inhibitors at .05	28			
L. S. D. for position at .05	6			

TABLE 3.—*Mean weight of sprouts per 100 tubers stored from October 22, 1951 to February 8, 1952. Katahdin variety.*

Inhibitors	Grams
MENA at 1 gm./bu. (2.2 per cent dust)	2
TCNB at 2.7 gms./bu. (3 per cent dust)	1
TCNB at 2.7 gms./bu. (6 per cent dust)	1
Untreated control	52
L. S. D. at .05	13

TABLE 4.—*Percentage of tubers infected with Fusarium expressed as the mean of four replications. Katahdin variety, 1951.*

Inhibitors	Position in Bin			
	Outer Half	Inner Half	Center	Mean
MENA (1 gm./bu.) 2.2 per cent dust	98	100	96	98
TCNB (2.7 gms./bu.) 3 per cent dust	81	84	73	79
TCNB (2.7 gms./bu.) 6 per cent dust	71	75	60	69
Untreated control	74	75	72	74
Mean	81	83	75	
L.S.D. for inhibitors at .05	8			
L.S.D. for position—not significant				

TABLE 5.—*Mean weight of sprouts per 12 tubers stored in paper bags from October 23, 1951 to May 7, 1952. Katahdin variety.*

Inhibitors	Grams
New MENA (1 gm./bu.)	8
Old MENA (1 gm./bu.)	12
TCNB (2.7 gms./bu.)	8
Untreated control	33
L. S. D. at .05	6

Fusarium dry rot is most frequently found. If injury from sprout inhibitors is to be avoided, a more suitable method of applying the inhibitor must be devised.

MENA was more inhibitory to sprouting than TCNB, when each was used at one gram per bushel of potatoes (Table 1). However, at the rate of 2.7 grams per bushel, the TCNB was equal to the MENA. The cost of TCNB is such that it can be marketed at a competitive price with MENA for treating equal quantities of potatoes. MENA increased Fusarium infection under conditions favoring the organism, whereas TCNB had no effect on the organism. This result, plus the fact that TCNB inhibited sprouting satisfactorily two years during the present study and one season previously (3), leads to the conclusion that TCNB is a more dependable material than MENA to use for potato sprout inhibition.

To gather more information on the effect of sprout inhibitors on small and large lots of potatoes, the small paper bag test was set up in 1951. The marked inhibitory effect of TCNB on tubers treated in small lots (Table 5) is in sharp contrast to previous results obtained by the senior author (3). The reason for this apparent discrepancy seems to be tied up with differences in the storage conditions. In the earlier work the potatoes were stored under warm, dry conditions (60° F. and 40 per cent R.H.) and the TCNB apparently volatilized before sprouting was inhibited. In the present study, the cooler, more humid storage conditions (35-45° F.) and 80 per cent R.H.) apparently favored persistance of the TCNB, with resulting sprout inhibition.

It was interesting to note that MENA, stored four years in the original cardboard drum, had practically the same inhibitory power as did a sample which had been recently formulated. This indicates that either the MENA gas is volatilized very slowly from the dust carrier, or that the cardboard drum is quite impervious to the gas.

Summary

Fusarium dry rot in potato tubers in storage was increased by treatment with sprout inhibitors containing methyl ester of a-naphthaleneacetic acid (MENA) as the active agent. Dusts carrying 2,3,5,6-tetrachloronitrobenzene (TCNB) had no effect on the incidence of dry rot in the tubers.

Sprouting was controlled satisfactorily by MENA at one gram per bushel and by TCNB at 2.7 grams per bushel of potatoes. The cost of treating potatoes would be approximately the same for either material. The TCNB at one gram per bushel did not inhibit sprouting satisfactorily. A four year old sample of MENA dust had essentially the same sprout-inhibiting effect as did a recently formulated sample.

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OUR MARKETS, OUR RESEARCH AND OUR SALES OF POTATOES

KRIS P. BEMIS[2]

A popular national magazine serving the retail grocery trade has for some years conducted a department called "Here's How I'd Merchandise ——". In this department, the editor invites specialists from different manufacturing companies to tell what they would do, if they were grocers, with the goods they know best because they manufacture and sell them. That magazine has not yet carried the idea beyond the field of manufactured products. So far as I know, it hasn't asked anybody to tell how he'd merchandise potatoes, if he happened to be in the imaginary position of controlling both their output and the departments of research, advertising and sales. But the idea is an interesting one, and we in the United have given it some thought, just "in case."

The 1951 crop season gave the potato business some valuable object lessons in merchandising. I refer particularly to the attempts at price control, later suspended. When supplies became scarce, grade and quality poor, and prices rose to black market levels, consumers acting singly and in organized groups simply boycotted the product and purchased substitutes. This condition is happily in the past, but the memory may well linger.

After several years of surplus, growers have voluntarily reduced acreage until the 1952 crop promises to balance pretty closely with requirements. But higher price levels usually arouse demand for better quality. Consumers spending 9 and 10 cents a pound for potatoes will be more critical than when they paid a half or a third of that price. We can't assume that our customers will cheerfully pay more money for poorer quality, just because of a shorter supply.

Who Are Our Customers?

If I were to tell how I'd merchandise potatoes, perhaps the first thing is to answer the question, WHO *are my customers?* In very rough figures, the people of the United States eat about 250 million bushels annually of potatoes purchased in the raw form. Another 30 million are consumed as food on the farms where produced. It takes another 30 million bushels for seed. The remaining 40 million bushels covers waste, shrinkage and cushion against local crop losses or disasters. This adds up to about 350 million bushels of estimated annual requirements. So it will be seen that housewives are our largest customers, using a little less than three-fourths of our production.

Restaurants and institutions serve slightly more than one-fourth of all food purchased, so they constitute our next most important outlet. It helps us to remember that this class of consumers is highly organized into trade groups to whom we can more effectively direct our merchandising message.

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[1]Given before The Potato Association of America, Ithaca, N. Y., Sept. 10, 1952.
[2]Secretary, Potato Division, United Fresh Fruit & Vegetable Assn., Washington, D. C.

The third group, but growing in importance every year, is the processors. They used about 30 million bushels last year in the manufacture of chips, canned potatoes, frozen French fries, soups, canned hash and stews, flour and meal.

Once we have recognized who our customers are, we need to know what they look for in our product; WHY do they buy it? What size, shape and color of potatoes do they prefer? What size of package, what kind of packaging material, and how displayed? What kind of cooking results do they expect? How will the results meet their expectations? For answers to questions like these, a manufacturer turns to his research department; in the fresh fruit and vegetable industry we must turn to you men who are doing a splendid job through countless and intricate avenues of investigation. Fortunately, since the passage of the Agricultural Marketing Act of 1946, a great many marketing surveys on potatoes have been conducted. Many of these deal with consumer preference in principal markets. Others deal with the maintenance of quality in marketing channels and the causes of deterioration between the field and the kitchen.

The Unanswered Question

One frequent question still to be answered in full, is "HOW can I be sure of getting potatoes that will cook well and taste good?" If we could provide a positive answer, there is good reason to believe that we could increase potato consumption considerably. Particularly do our restaurants and other public feeding establishments *need standards* whereby they can be sure of providing uniformly good-tasting potato dishes in some form, in all months of the year. From the cooking test project being carried on at Beltsville, Maryland, and from other work done elsewhere, we already foresee the commercial application of two tests for predetermining cooking quality. One of them is the specific gravity test; the other is a standard for color control for potatoes processed into chips or other fried forms. We seem to be on the threshold of further discoveries as to the effect of the protein content of the potato upon some forms of cooking. All of which emphasizes the great importance of carrying this work still further and establishing an increasing number of these standards for use, not only by institutional users and processors, but by the housekeeper, too.

The commercial classification of potatoes into different specific gravity grades may well be one of the next steps undertaken by potato shippers. The specific gravity of potatoes varies, not only by locality and variety, but actually between different tubers in the same hill, and in different parts of the tuber itself. Thus individual separation is necessary. Potatoes of low specific gravity are not of themselves undesirable. Further research may develop better methods of cooking them into highly palatable forms. We don't need to be afraid of specific gravity separation, for fear that it would take off the "cream," leaving the "skim milk" of lower gravity potatoes on our hands. Instead, we need to continue our research, and to move forward with confidence.

Potatoes Aren't Sold Alone

While potatoes are by far our most important vegetable, and are a large volume item in retail stores, they are not merchandised by themselves. They are sold as one commodity in a department where at least 20

to 30 other fresh fruits and vegetables should be available. Experienced merchandising men believe that potato promotions belong with systematic promotions of all fresh fruits and vegetables, and of the department as a whole.

A better understanding of nutrition is credited with having helped increase fresh fruit and vegetable consumption in recent years. It seems logical to conclude that teaching the nutritive value of potatoes should go along with a program of telling the virtues of all fresh fruits and vegetables.

In an industry like ours, overall promotional efforts usually have to be initiated by a trade association. The United has been doing something about this for several years. Space permits giving only a few examples.

Truck Posters Help

Common observation on any busy city street will show that the side of a commercial truck body is regarded as valuable advertising space. Thousands of trucks are owned and operated by firms in the fresh fruit and vegetable business. Why not use them to advertise our products?

Starting in November, 1947, the United began a program of printing and distributing each month a large attractive colored poster showing fresh fruits and vegetables in some form. Such a poster has appeared every month since. Some of the posters are what is called "institutional." They show a mass display of many of our products. In such cases the United pays for the poster and its distribution. But a "specialty" poster, advertising oranges or apples or potatoes, is paid for in part by that branch of the industry which it benefits. Two potato posters have appeared, the first in March 1951 and the second a year later. The monthly mailing list of poster users has grown steadily until hundreds of trucks are now rolling over our highways, presenting appetizing messages about our products. The posters are also used for display in store interiors, in warehouses and even in public schools. Let's take a look at this last one.

School Teachers Help

There's a large group of customers that needs potatoes in its diet, and it's a group still largely unaware of the "feminine fear of fat." This group is the growing boys and girls in our grade schools. To reach this group, United has cooperated with a leading national educational magazine, "The Grade Teacher," in producing an 8-page brochure in full color entitled "Health from Field and Orchard." It tells of fresh foods from far and near; of fresh produce, guardian of our health. Profusely illustrated, it tells of such things as where our fruits and vegetables grow; the magic of transportation; the complexity of marketing; the nature of protective foods, and what fresh produce gives us.

For the teacher, the pamphlet gives outlines for relating the facts about fresh fruits and vegetables to social studies, to arithmetic, science, English, art and even to school room decoration. United has placed more than 400,000 copies of this pamphlet in the schools. Demand has been unprecedented. Along with it have gone many other information sheets about our products. Many wholesalers have cooperated in furnishing their city schools with copies of the colored truck poster. Since the

pamphlet was introduced in February, 1952, more than 6,000 individual requests for it have come from schools throughout the United States and Canada. The demand continues, and the end doesn't seem to be in sight. It must be influencing to some degree the attitude of many families toward fresh fruits and vegetables in the diet.

Other Trade Groups Help

I have mentioned that the public feeding industry is highly organized into trade groups. One of these is The National Restaurant Association of some 7,500 members who are still further organized in 112 state and local associations. The United has worked closely with this Association for several years. In 1947 the NRA established a department for Food and Equipment Research. It is directed by Colonel Paul P. Logan, whose knowledge of and interest in potatoes is well known.

Maintaining no large technical staff of its own, The National Restaurant Association gets results by utilizing the research facilities of the Government, of large processors and food manufacturers and of colleges and universities. It has a technical advisory food committee composed of executives, operating officials or dietitians of such organizations as Schrafft's, Walgreen Stores, F. W. Woolworth Company, Chicago Board of Education and many others. This technical committee is well aware that potatoes offer unique opportunities for lowering restaurant food costs. When handled in certain ways, potatoes can also lower labor costs. These cost items are perhaps the most serious and troublesome in restaurant operation.

What Restaurants Need

Every year The National Restaurant Association holds an immense annual convention and food and equipment display. New ideas in food service are there presented in stage-and-actor form before groups as large as 6,000 people. Last year the subject was the service of one-plate meals. (Many of them contained potatoes). On a previous occasion a stage show demonstrated proper temperature controls in French frying potatoes. For next year even better things are planned.

For example, mashed potatoes are considered a "must" item, even from May to September. In many cities, it's difficult to serve good mashed potatoes in those months. It helps if potatoes have high specific gravity. A really good dehydrated potato might improve the quality of the dish and stimulate sales in summertime. Both these approaches will be tried out by the Committee.

Will it save kitchen labor if potatoes are graded by size before mechanical peeling? Will it also reduce wastage? The Committee proposes to look into it.

Hashed browned potatoes, properly made, are delicious; moreover, they sell fast and are profitable. Different methods of cooking in individual dishes have been tried. A new type of perforated metal dish with a broad lip which will conduct more heat from the surface of the griddle, will be under test.

Sometimes French fries turn out dark, or limp, or greasy, or all three. Tests for specific gravity, for reducing sugar, and possibly a de-sugaring process might help. The Committee will try to find out.

Do we really know the correct temperature for preparing baked potatoes? Can a potato of low specific gravity be baked in a way to make it less moist? Interesting and important experiments are planned by the Committee and the results will be made known. The fall and winter months of 1952 will find NRA's Technical Advisory Food Committee working with the School of Food Engineering at Illinois Institute of Technology, with the Eastern and Western Regional Research Laboratories of USDA, with the laboratories of the Army Quartermaster Corps, with the United and with several commercial potato companies. The results will be presented at the Food Show of 1953 which is part of the NRA Convention meeting held in May at Chicago.

In concluding this story on "How I'd Merchandise Potatoes," the last paragraph would be the easiest one to write. It would deal with their display, care and handling in the retail store. United's Merchandising Institute has pretty well set a pattern for the conduct of a successful retail fresh fruit and vegetable department. Since its beginning in November 1947, over 3,000 UMI classes of grocers have been held in cooperation with the United States Department of Agriculture, in 130 cities. These cities extend through 37 states, the District of Columbia, the Territory of Hawaii and several provinces in Canada. More than 26,000 retailers and 4,000 wholesale employees have taken this one-day course of instruction. Again, potatoes are not merchandised by themselves, but are, in point of volume, the most important of fully 100 fresh fruit and vegetable items. The job of promoting their sale in fresh form at retail is merely a part of the larger job of selling all fresh fruits and vegetables through this department.

The work of developing our markets, expanding our research and stimulating our sales of potatoes has barely begun. One trade association, with limited funds and personnel has begun to make fresh food facts available to the teachers at our grade schools. It has built a program for the monthly printing and distribution of attractive colored advertising posters. It is cooperating with the largest organization in the public feeding industry, to find out how to predetermine cooking quality, and how to make better potato dishes available in a business which serves over 65 million meals per day to the American people.

Much more remains to be done before the fresh fruit and vegetable industry can consider itself on an equal footing with others in the food field. But at least we are learning the direction in which to go. Properly directed research work will provide many of the tools for the job.

DR. FREDERICK J. STEVENSON HONORED

Dr. Frederick J. Stevenson, Principal Geneticist, Division of Vegetable Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, United States Department of Agriculture, Beltsville, Md., was elected an honorary life member of the Potato Association of America at its Annual Meeting in Cornell University, Ithaca, New York on September 7, 1952.

Dr. F. J. Stevenson has had a remarkable and varied career as a parent, teacher, and scientist. First, he is the father of eight children — 2 boys and 6 girls. His children are all college graduates except two, one of whom is in college at present and the other in junior high school. One son has his Ph.D. and the other has completed all his work for this degree with the exception of his thesis. Dr. Stevenson was born on Prince Edward Island, Canada, in 1886, where he received his elementary and secondary education. For several years he taught and acted as principal in the secondary schools of the State of Washington. The State College of Washington awarded him the degrees of Bachelor of Science in 1922, Master of Science in 1925, and Doctor of Philosophy in 1929.

From 1919 to 1922, Dr. Stevenson was an Assistant Farm Crops Specialist at the State College of Washington, and from 1922 to 1925 an Instructor and Superintendent of Practice Teaching. In 1925 he moved to the University of Minnesota as Assistant Professor of Agronomy and Plant Genetics and remained there until 1930. Since then he has been associated with the United States Department of Agriculture as a geneticist, senior geneticist, and principal geneticist to lead the National Potato-Breeding Program, which was organized in 1930. Under the direction of Dr. Stevenson this program has been enlarged on a cooperative basis to include formal agreements among 25 States and the United States Department of Agriculture, and informal cooperation with 16 additional States. Also, informal cooperation is carried on with Canada and many other foreign countries.

The outstanding success and progress of the National Potato-Breeding Program since 1930 are largely due to the knowledge and ability of its leader, Dr. Stevenson, who directly and indirectly has been responsible for the introduction of 27 potato varieties since 1932. In 1951 these new varieties accounted for nearly 50 per cent of the certified potato seed produced in the United States and more than 70 per cent of the seed production in the three maritime provinces of Canada.

Breeding potato varieties resistant to virus, fungus, and bacterial diseases and superior in cooking and marketing qualities has been stressed with exceptional results by Dr. Stevenson. He has been responsible for the development of potato varieties and seedling varieties that show resistance to several diseases combined in them. His contributions to the literature on the cytology, breeding behavior, and genetic analysis for several disease-resistant characters have added immeasurably to the future information of the potato breeder. During his 22 years of research with potatoes he has become the leading authority in this country on potato investigations and has an enviable international reputation.

HAROLD J. "RED" EVANS HONORED

Mr. Harold J. "Red" Evans, representative and champion of the potato industry in New York State, and also in the eastern part of the United States, of Georgetown, New York, was elected an honorary life member of the Potato Association of America at its Annual Meeting at Cornell University, Ithaca, New York on September 7, 1952.

"Let 'Red' do it" seems to be a favorite motto of potato growers and handlers in parts of eastern United States and also of "Red's" fellow citizens of whatever occupation in Madison County, New York. "Red" has been "king pin" in a surprisingly great number of groups organized to look after the interests of potato growers and other agricultural and non-agricultural segments of the population.

Harold James Evans was born at Broadalbin, near Schenectady, New York, January 17, 1893. He was reared on a farm. In June, 1917, he graduated from Cornell University and in November of the same year married Elizabeth Brown. They have two sons, Norman B. and Harold J., Jr.

After graduation he was employed by the New York Agricultural Extension Service, being Assistant County Agent in Oswego County, 1917-1918, and County Agent for Nassau County, from 1918 to 1922. From 1922 to 1930 he was District Representative on Long Island for the Niagara Sprayer and Chemical Company, Inc.

Since 1930 he has been Secretary-Treasurer and, as such, General Manager of the New York Cooperative Seed Potato Association, Inc. Almost continuously since 1930 he has grown certified seed potatoes. In recent years poor health has, however, forced him to withdraw from active participation in the growing operations on his own farm at Georgetown.

The following list cites some of his additional occupations and services, present and recent. It is certainly impressive:

Chairman of the Potato Advisory Committee under the Research and Marketing Act.

President, now and frequently in the past, of the Empire State Potato Club, the organization of potato growers in New York State.

Vice-President for 1952, and also for 1949 and 1950, of the Vegetable Growers' Association of America. Mr. Evans represents the Potato Section.

Secretary-Treasurer of the Central New York Potato and Vegetable Council, a three-county group of growers.

Vice-Chairman of the New York State Soil Conservation Committee, 1947-1948, and Chairman of the Committee from 1948 to date.

A member, during World War II years, of the Potato Advisory Committee to the United States Office of Price Administration, the Certified Seed Potato OPA Committee, and the Production and Marketing Administration Potato Advisory Committee for New York.

Has been Director-at-large of the National Potato Council from its inception to the present.

The above record speaks for itself. Few of us have realized how large a part "Red" has played and is playing, under present political and sociological conditions, in the development of the potato industry in looking after the interests of those whose livelihood comes from the potato business.

MINUTES OF MEETING OF EXECUTIVE COMMITTEE

Willard Straight Hall, Cornell University, Ithaca, N. Y.

September 7, 1952

Present — President — G. H. Rieman

Vice President — J. H. Muncie

Treasurer — John Campbell

Directors — A. Hawkins and N. M. Parks

A number of matters of business relative to the association were discussed, among which was the question of how "membership in the association" and "circulation of the journal" could be increased. It was the opinion of the members of the executive committee present that if a section in the journal were devoted to articles of a more popular nature that the journal would have greater appeal to growers and the industry as a whole.

Mr. C. S. Macfarland, advertising manager for the journal, met with the executive committee and discussed the question of obtaining advertising. He pointed out the difficulties in interesting firms in advertising in a periodical which has as limited a circulation as the American Potato Journal.

It was decided to place the question of a change in the journal to the general meeting for their consideration. This matter to be presented by Dr. Muncie to the members present at the business meeting on Tuesday morning.

Membership Rates

(a) *Group Membership*

Rates for group membership were reviewed in detail and discussed at considerable length. From information provided by The Treasurer it was found that group memberships at the present rate of one dollar per member — may cost the association a few cents each. However, in view of the fact that the only way increased advertising for the journal can be obtained is through increased circulation, it was decided to leave group membership rates at one dollar per member, with fifty (50) members the minimum number in any one group at this rate.

(b) *Sustaining Membership*

It was felt that as many sustaining members as possible should be obtained, in an attempt to build up a reserve in the finances of the association.

A suggestion was made by Dr. Muncie that a "selected" list of leading growers be interviewed in regard to becoming "Sustaining Members." Also, outstanding industrial firms who handle potato growers' supplies as well as potato processors. Further, that the members of the Sustaining Membership Committee submit names of industrial firms whom they think might be interested in be-

coming sustaining members to the chairman of the Sustaining Membership Committee, in order to avoid duplicate canvassing of the same firm, so that the canvass can be co-ordinated and the approach made in the most effective way.

(c) *Honorary Membership*

It was decided that the executive committee would recommend that the number to whom Honorary Life Membership be given be changed from a maximum of two to a maximum of four in any one year.

(d) *Life Membership*

Members of the executive committee present were of the unanimous opinion that life membership in the association should be discontinued and that the Constitution be changed accordingly.

Dr. Rieman suggested that in the future the executive committee should meet for one day previous to the annual meeting in order to discuss the business agenda. This suggestion was unanimously agreed upon and adopted.

N. M. Parks, *Secretary, Pro Tem*

MINUTES OF ANNUAL MEETING

Cornell University, Ithaca, N. Y.

September 9, 1952

Meeting was called to order by President G. H. Rieman.

In the absence of the Secretary, Dr. Ora Smith, his secretary was appointed to serve in this capacity.

The Secretary's Report was presented and accepted.

Paul Eastman gave the report of the Certification Committee.

R. W. Hougas presented the Potato Introduction Committee report. The report was accepted.

Arthur Hawkins gave the Membership Committee report. It was moved and seconded that the Executive Committee be empowered to amend the By-Laws to elect up to four Honorary Life Members each year. Motion carried.

J. H. Muncie presented the report of the Sustaining Membership Committee.

Marx Koehnke presented the Life Membership Committee Report. The motion was made and seconded that the By-Laws be amended that Life Memberships be discontinued. Motion carried.

In the absence of Dr. Martin, J. C. Campbell presented the Editor's Report. Report accepted.

J. C. Campbell presented the Treasurer's report, a copy of which is attached. Report was accepted.

A vote of thanks was given the Treasurer and Editor for their efforts.

H. J. Evans gave the report of the Auditing Committee. Report was accepted.

J. W. Scannell presented the report of the Nominating Committee. The following officers were elected for the year 1953:

President — J. H. Muncie
Vice President — Arthur Hawkins
Director for 3 years — C. W. Frutchey
Director for 2 years to fill the unexpired term of Arthur Hawkins — Paul Eastman.

Paul Eastman issued an invitation on behalf of the University of Maine to the Potato Association of America to hold a Summer Field Meeting the first week in August, 1953, at Orono and Presque Isle in conjunction with the American Society of Agronomy. This is to be a tour and no papers presented.

In view of the fact that the annual meeting is to be held in September it was decided not to accept the invitation.

A discussion was held as to the time and place of the 1953 annual meeting. It was brought to the attention of the Association that there were many advantages in meeting with the A.I.B.S. as was done last year and it was decided that we would meet with the A.I.B.S. in September at the University of Wisconsin, Madison, Wis.

Meeting Adjourned.

Dorothy Laubengayer, *Acting Secretary*

MINUTES OF MEETING OF EXECUTIVE COMMITTEE

Williard Straight Hall, Cornell University, Ithaca, N. Y.

September 9, 1952

Present — G. H. Rieman, J. H. Muncie, J. Campbell, A. Hawkins, N. M. Parks, P. J. Eastman, C. W. Frutchey, M. Koeknke.

I Re Sustaining Members

It was agreed that not more than 2 or 3 complimentary copies of the journal should be sent to each sustaining member.

II Honorary Membership

That nominations for honorary membership be submitted to the secretary early in the new year and a list be developed and completed by March 1st each year. Each executive member to select seven (7) in order of preference — four to be the maximum number elected in any one year.

III Re Membership Drive

It was agreed that a letter head should be set up including the names of the membership committee and the State membership chairmen. Also, that a suitable letter be prepared and printed in "off set" type press for each regional officer to send out to growers and prospective members.

IV Re New Section in Journal

Each executive member to send a suggested title for popular section to John C. Campbell. The editor to deal with the matter of an insert in the journal announcing the new section.

V Appointment of Secretary

A letter was read by President Rieman from Ora Smith, asking that he be released of the secretary's duties and a new appointment be made.

R. H. Hougas of Madison, Wisconsin, was appointed Secretary.

VI Re Meeting Place for Next Annual Meeting

It was unanimously agreed that the Executive should meet one full day previous to the annual meeting to discuss matters of business relative to the association. Also, that the President prepare an agenda for the Executive meeting and submit copy of each to the executive members previous to the meeting. The meeting will be held at the University of Wisconsin, Madison, Wis.

VII

The following motion was moved by E. W. Frutchey, seconded by J. H. Muncie, If funds are available during the association's fiscal year 1952-1953, an increase of 10 per cent in salary is to be paid the treasurer of the Potato Association and the associate editors of the potato journal. Motion carried.

VIII

A motion moved by Arthur Hawkins, seconded by N. M. Parks that the treasurer by instructed to give the sum of $15.00 to Dr. Ora Smith's secretary, Miss Dorothy Laubengayer, in appreciation of clerical services she rendered to the association.

N. M. Parks, *Secretary Pro-Tem*

TREASURER'S REPORT

THE POTATO ASSOCIATION OF AMERICA

Statement for the Year Ending November 30, 1952

Receipts			
Bank Balance on Hand November 30, 1951	$ 173.01		
Lelah Starks Fund	587.08		
Annual Dues	4,877.17		
Sale of Advertising	2,432.50		
Sale of Reprints	1,163.05		
Sale of Index	189.00		
Miscellaneous, Back Numbers, *etc.*	283.24		
Total Receipts		$9,705.05	
Disbursements			
Printing of Journal (13 issues), inc. $848.32 from 1951	$5,650.41		
Printing of Reprints, inc. $101.13 from 1951	734.43		
Mailing and Supplies	797.92		
Balance on Index from 1951, $359.50	359.50		
Editorial Salaries inc. $100 from 1951	500.00		
Treasurer's Salary	600.00		
Miscellaneous	155.35		
Total Disbursements, includes $1408.95 for 1951 bills		$8,797.61	
Bank Balance on Hand November 30, 1952		$ 907.44	
Accounts Receivable			
Advertising—October (Approx.)	130.00		
Reprints — Billed but not paid	461.00		
Back Numbers of Journal	170.75		
Total Accounts Receivable		$ 761.75	
Balance on Hand plus Accounts Receivable			$1,669.19
Accounts Payable			
Printing Reprints	$ 141.05		
Balance due on Editorial work from 1951	300.00		
Balance due on Treasurer's work from 1950 and 1951	450.00		
Total Accounts Payable			$ 891.15
Net Assets			$ 778.04

This compares very favorably with the $1,273.19 deficit reported last year.

John C. Campbell, *Treasurer*

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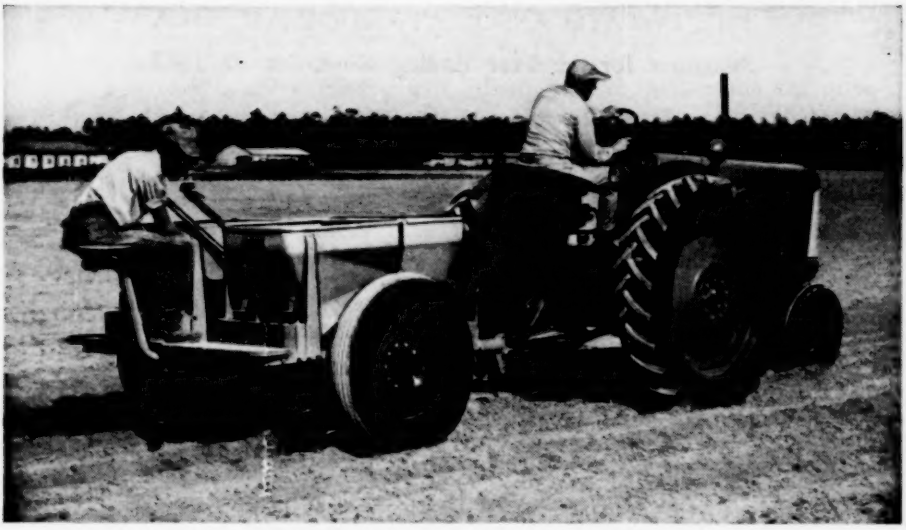

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